P-2.8 Distinguish between static and kinetic friction and the factors that affect the motion of objects

Revised Taxonomy Level 4.1B Differentiate (distinguish) conceptual knowledge

Key Concepts

Static (limiting) frictional force
Kinetic (dynamic) frictional force
Coefficient of friction (μ)

In physical science, students define friction as a force opposing motion.
They do not distinguish between static and kinetic friction.

It is essential for students to

- Qualitatively and quantitatively compare static friction and kinetic friction
  - Students should understand that friction is caused by the intermolecular force between the molecules of two surfaces
  - Students should understand that static (limiting) friction is the maximum value of the frictional force between two surfaces. It occurs when the two surfaces are on the point of sliding over each other.
  - Students should understand that kinetic (dynamic) friction is the value of the frictional force when one surface is sliding over another at constant speed. It is slightly less than static friction.
  - Students should understand the factors that affect friction
    - Normal force (f_n) (the net force perpendicular to the surface)
    - The physical properties of the two substances
    - The chemical properties of the two substances
  - Students should understand that the ratio between the frictional force between two surfaces to the force that is pushing them together (the normal force) is called the coefficient of friction.
    - The coefficient of sliding friction is slightly different from the coefficient of static friction for any given combination of substances
    - Both the coefficient of sliding friction and the coefficient of static friction are constant for a particular combination of substances
  - Students should use the equation $\mu = f_f / f_n$ to solve problems involving the motion of objects

Assessment

As the verb for this indicator is differentiate (distinguish), the major focus of assessment should be for students to distinguish between the relevant and irrelevant parts or important from unimportant parts of presented materials. Because the verb is differentiate rather than compare, students should assess the motion of an object in order to determine the factors that are important in determining the effect of friction (both static and kinetic) on an object. Students can use a free body diagram and their knowledge of the laws of motion in order to determine the normal force or the frictional force exerted by an object.